

HEALTH CARE

Strategies for Greener Hospital Operating Rooms

Hospitals produce prodigious amounts of waste each day, with operating rooms (ORs) and labor and delivery units contributing the majority.¹ Yoan Kagoma and colleagues at the University of Western Ontario measured the waste from total knee replacements in Canadian hospitals and found this procedure alone produced about 450 tons of waste over the period 2008–2009.² Astounded by these results, they analyzed 65 published studies about the environmental impact of OR waste and practices, and concluded in the 4 June 2012 issue of the *Canadian Medical Association Journal* that the “provision of health care is not benign, and many of the interventions used to save lives [adversely] affect the environment.”³ However, they also uncovered several green practices that are easily implemented and can save money without compromising patient care.

Some green strategies are nontechnical; one example is carefully sorting OR waste. Managing biohazard waste—which includes body fluids, tissues, and anything they touch, such as sponges, gowns, and gloves—requires autoclaving, incineration, and other energy-intensive processes. Yet up to 90% of waste tossed into biohazard containers is nonhazardous,⁴ partly because staff are overly cautious and partly because it's easier to put all waste in one container instead of taking time to sort it, Kagoma says. In 2010 more attention to segregation at one hospital in Pittsburgh, Pennsylvania, reduced by half the amount of biohazard waste processed and saved \$89,000 in associated costs.⁵ Reducing biohazard waste also means less is incinerated, a process that produces toxic nitrous oxide, polychlorinated biphenyls, furans, and dioxins.⁶

A more technical solution sequesters OR anesthetic gases such as isoflurane. This and other halogenated ethers are up to 3,760 times more powerful at trapping heat than carbon dioxide, and up to 95%

of anesthetics are vented to the outside.⁷ By one estimate, the yearly anesthetic gas emissions from a midsize hospital are equivalent to carbon dioxide emissions from 1,200 automobiles.⁷

ORs across Ontario now capture 100% of anesthetic gases with Deltasorb® canisters, developed by Blue-Zone Technologies in Concord, Ontario. An inner crystalline matrix traps only halogenated anesthetics, which the company recovers and recycles.⁸ Chemical engineer Dusanka Filipovic, co-inventor of the technology with anesthesiologists at the University of Toronto, says that in addition to keeping greenhouse gases out of the atmosphere, recycling ensures a secure supply of anesthetics, many of which are in short supply.⁹ Just a few companies manufacture the anesthetics used by ORs in developed countries. “We improve supply security by recycling them,” Filipovic says.

A quarter of hospitals reprocess single-use OR devices such as ultrasonic scalpels and trocars (used to puncture the skin to drain fluids).¹⁰ In the United States, reprocessed devices are decontaminated and tested for proper functioning before reuse by commercial reprocessors under Food and Drug Administration guidelines. One reprocessing company saved its customers more than \$138 million and diverted 2,150 tons of waste from landfills in 2008.

Although reprocessing requires energy and cleaning agents, “these items are very functional and should be recycled instead of mining new metals or making new plastics to replace them,” says Kagoma. Stryker Sustainability Solutions, a major reprocessing company in Tempe, Arizona, uses all biodegradable cleaning agents and recycles OR devices that cannot be reprocessed. “Reprocessed items cost about half as much as new counterparts, because we're not creating new raw materials,” says Emily Hansen, associate marketing director at Stryker.

“Overage” also plagues ORs, which often use prepackaged supply kits for individual surgeries. The kit may include up to 100 items that are set out for surgery but remain unused, and once

The Beat

by Erin E. Dooley

C8 Phased Out of Food Wrappers

In July 2012 the U.S. FDA released a statement that manufacturers had voluntarily ceased selling agents containing the compound C8 for food-contact use the prior summer.¹ At that time, manufacturers had predicted stocks of the agents and packaging containing them would be depleted within a year. C8, or perfluorooctanoic acid, was used to keep oil and grease from seeping through food packaging. It is persistent in the environment and has been linked with testicular and kidney cancers and pregnancy-induced hypertension.² The compound is still used in products such as cookware and clothing.

Where's the Cleanest Beach?

In June 2012 the Natural Resources Defense Council released its annual *Testing the Waters* report on water quality at U.S. ocean and Great Lakes beaches.³ Certain beaches in Alabama, California, Delaware, Maryland,

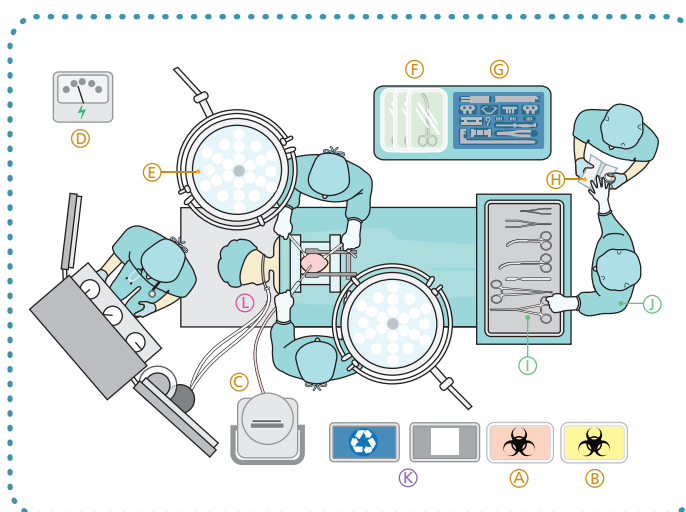


Minnesota, New Hampshire, and Texas have exceptionally low contamination rates and strong testing and safety practices, earning them the report's five-star rating. But the past two years had the second and third highest numbers of beach closures and advisories in the past two decades, with the majority a result of contamination with human or animal waste. The report cites measures to reduce stormwater runoff and

sewage spills as top priorities for reducing beach closures and illnesses.

Rio+20 Envisions *The Future We Want*

In adopting the consensus document *The Future We Want*,⁴ parties to the June 2012 United Nations Conference on Sustainable Development (Rio+20) renewed their commitment to a number of principles and goals supporting environmental health alongside development. Among other statements, parties expressed support for access to cleaner energy, including cleaner fossil fuels; urban planning that promotes a safe, healthy environment for all residents; improved sanitation to combat the spread of communicable diseases; sustainable food networks and water usage; and occupational settings that meet minimum safety and health standards. In conjunction with the conference, government and private stakeholders around the world declared over 700 voluntary commitments



REDUCE

- (A) Proper waste segregation
- (B) Reusable sharps container
- (C) Fluid waste management
- (D) Energy expenditure
- (E) LED surgical lamps
- (F) Greener equipment packaging
- (G) Reusable hard case
- (H) Just-in-time model to reduce overage

REUSE

- (I) Reprocessing of single-use devices
- (J) Reusable surgical linens

RECYCLE

- (K) Recycle clean plastic and paper

RETHINK

- (L) Anesthetic gas reclamation

RESEARCH

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the outer packaging of the kit is open, the unused items must be discarded. By redesigning surgical kits to include only necessary equipment, a Minneapolis, Minnesota, medical center avoided more than 2.5 tons of waste and saved \$81,000 in 2010.⁵

Kagama's team tackled overage another way: by founding Operation Green, which collects unused sponges, gloves, gauze, syringes, and other items from ORs in Ontario.¹¹ The items are donated to the nonprofit International HOPE Canada and sent to hospitals and clinics in developing countries. Operation Green is modeled after REMEDY (Recovered Medical Equipment for the Developed World), a 20-year-old project at Yale University that has donated more than 50 tons of recovered medical materials since it began.¹² "It only takes a few individuals who are interested in making a change," says Kagama.

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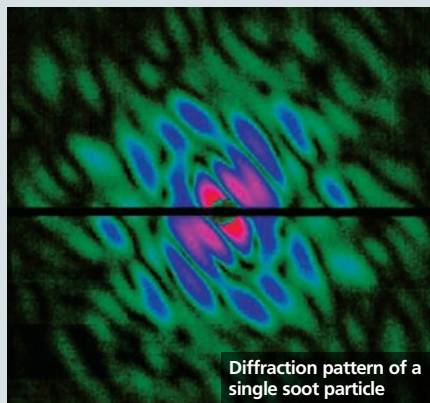
worth more than \$500 billion toward meeting these goals.

Study Refines Climate Change and Wildfire Predictions

A new study employing satellite-based wildfire data from the past decade and 16 different global climate change models (GCMs) estimates that the likelihood of fires like the summer 2011 events in western United States will particularly increase in mid- and high-latitude areas of the Earth in the next 30 years.⁵ For both the near- and far-term time periods assessed, models for several biomes—including Mediterranean biomes, montane grasslands and shrublands, and temperate coniferous forests—show general agreement for increased fire probability. The authors write, "Although GCMs predict that temperatures will rise virtually everywhere on Earth over the next century, future fire occurrence appears to primarily be a function of the available moisture in many areas."

Particles Unveiled in Flight

It has been difficult to image particulate matter (PM) without introducing artifacts caused by capturing particles for microscopic analysis. Now researchers have found a way to do so using the Linac Coherent Light Source free-electron laser, the world's most powerful X-ray laser.⁶ A stream of aerosol particles was shot across the pulsed X-ray beam,



producing high-resolution diffraction patterns for individual particles. Simultaneously, ion fragments ejected from the beam were analyzed with mass spectrometers to study the composition of single particles. Among other findings, airborne soot particles were shown to be more compact than previously thought, an insight that could help improve climate change models since soot's structure determines how it scatters light.

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